Behaviours of the Precipitates of 17-4 PH Stainless Steel by the Arc Welding Heat

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Abstract

Behaviours of the precipitates and hardness in the heat-affected zone of 17–4 PH stainless steel were investigated. The heat-affected zone was obtained by single bead welding using a TIG arc method, in which a single bead 10 cm in length was placed on the 17–4 PH stainless steel plate of $20\times50\times200$ mm^3. To analyze the precipitates and the hardness distribution in heat-affected zone, the specimen, 15 mm in length and 5 mm in diameter, was rapidly heated and cooled by the reproducing weld thermal cycle apparatus using a high-frequency induction heating. The hardness of the specimen subjected to the thermal cycle by the reproducing weld thermal cycle apparatus was compared with the hardness in the heat-affected zone subjected to the weld thermal cycle under TIG arc welding. The results may be surmmarized as follows:

(1) In the heat-affected zone of 17–4 PH stainless steel solution treated, the maximum hardness was obtained at about 600°C, and this temperature was about 100°C higher than that of ordinary precipitation treatment. The higher the precipitation temperature, the lower became the maximum hardness with increasing precipitation time.

(2) In the base metals subjected to the reproducing weld thermal cycle at a peak temperature of 650°C prior to the precipitation treatment, there appeared some parts which were not hardened by the precipitation treatment. The softening temperature by the weld thermal cycles in the heat-affected zone of the base metal subjected to the precipitation treatment ranged from 650° to 900°C, and the solid solutioning was fully accomplished at a temperature above 900°C.

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